SmartConnect Use Case:

D10 – Field Worker uses Consolidated Mobile Solution (CMS) for inspection and repair work

April 08, 2009

Document History

Revision History

Revision Number	Revision Date	Revised / Reviewed By	Summary of Changes	Changes marked
(#)	(yymmdd)	(Name)	(Describe change)	(Y/N)
0.1	081030	Kevin Clampitt	Initial draft from workshop on October 21, 2008	N
0.2	081308	Bryan Lambird	Second draft	N
0.3	090325	Kevin Clampitt	Third draft	N

Approvals

This document requires following approvals.

Name	Title
Bryan Lambird	Project Manager, Planning & Policy Support
Phil Pivovaroff	Manager, Distribution, Construction & Maintenance
Percy Haralson	Manager, Field Technologies

Contents

1. Use Case Description

1.1 Use Case Title

Field worker uses Consolidated Mobile Solution (CMS) for inspection and repair work.

1.2 Use Case Summary

This use case describes three scenarios in which field workers use a local CMS device in conjunction with inspections and maintenance activities. CMS provides field workers with real-time communications, improved availability of information, and enhanced visual displays, all of which enable field workers to perform their work with improved efficiency and safety. Corporate facility maps, the Asset Management System (AMS) and Condition-Based Monitoring Systems (CBMS) are also rendered more accurate and useful by CMS, which populates these systems with current asset information and sensor data from the field with increased timeliness and frequency.

1.3 Use Case Detailed Narrative

Field employees currently perform work utilizing information either from paper documents or from “ruggedized” laptop computers brought to the field. These computers contain large amounts of useful information (e.g. asset information, maps, work orders, and manuals). However, this information is not always current since it is not updated throughout the day in real-time. The field worker must connect with the network at the office to obtain updated information. Likewise, back office systems do not obtain updated information from the field (e.g. status of current work orders, missing or incorrect asset information, inspection results, and work orders generated in the field) until the work is completed and the field worker returns to the office to turn in completed paperwork or connects their laptops to the network. This lack of automated information exchange between field workers and the back office leads to operating inefficiencies (errors, delays and reduced work capacity), and inaccurate asset information.

The introduction of SmartConnect, AMI and other Smart Grid technologies will produce new real-time data and information about the state of distribution assets. If this information could be made available to personnel in the field it would make them more productive, and it would foster a safer work environment. This would be particularly beneficial to field workers performing trouble work, as accurate information could be provided with respect to transformer, power line and asset loadings, and outage flags from meters, to name a few. If this new information could be presented to field workers in a graphic interface format using real-time communications, workers would experience productivity gains and a reduction in work-related accidents and injuries.

CMS represents an opportunity to realize these benefits by improving and expanding the use of mobile communications technologies by field workers. CMS refers to a collection of remote field tools, mobile software, and the associated communications network infrastructure all of which enable field workers to engage in two-way communications with back-office systems in real-time or near real-time.

This use case examines some of the potential applications of CMS by considering the following three scenarios:

1. Field worker performs asset inspection with CMS.
2. Field worker receives planned work assignments and completes work using CMS.
3. Field worker receives unplanned work assignments and completes work using CMS.

Scenario 1

The first scenario describes how an Electrical System Inspector (ESI) performs an Overhead Detailed Inspection (ODI) on grid assets using a CMS device. Although this scenario describes an ODI, the steps would apply to any asset inspection. ODI inspections are performed once every five years, according to mandates by state regulators. These inspections consist of an ESI driving out to a grid location to inspect the distribution assets within a 0.5 square mile area. In addition to the 5-year inspection, grid assets are also visually inspected once per year as part of the Annual Grid Patrol (AGP). The AGP consists of an ESI performing a visual inspection of distribution assets, often from a moving vehicle. Ideally an ESI would perform these AGP inspections while en-route to perform the ODI inspections, making use of idle drive time. One of the benefits of CMS is mapping driving routes for the ODI inspections that incorporate areas in need of AGP inspections.

Having received a work order to perform an ODI inspection, the ESI travels to the grid location following the route specified by CMS. While en-route, the ESI performs visual AGP inspections of the assets he passes. Simultaneously, CMS devices in the vehicle passively monitor these same assets. This monitoring may also be performed using small unmanned aerial vehicles. Passive monitoring enabled by RFID or other sensors associated with each respective asset may include the following:

(1) Read RFID tags to validate structures/assets at current location or identify errors in the utility's facility maps.

(2) Perform thermal imaging to identify assets that are overheating and in need of repair, and send an alert back to the Asset Management System in real-time.

(3) Conduct noise analysis for noise or humming that could indicate emerging problems.

(4) Read other sensor data that could indicate emerging problems.

Once CMS collects the data, it stores and forwards it back to the back office systems (AMS and CBMS). This data is sent either real-time or near real-time, depending on the priority and urgency of the information. AMS then uses the field data to either validate or correct asset information, thus improving the accuracy and usefulness of the facility maps. CBMS receives sensor data and other asset information to identify emerging asset failures and other threats to the health of the distribution asset. Note that CBMS will likely receive additional asset information outside the CMS communication pathway. This is discussed in more detail in use cases D14 and D19.

Upon arriving at the inspection location the ESI validates the location and asset information by reading the RFID tags and other sensor data. Other CMS devices residing on both the ESI and vehicle perform passive monitoring and collection of asset sensor data. This is similar to passive monitoring performed en-route for the AGP. CMS enables the ESI to confirm the presence of assets expected to be at that location. It also allows the ESI to identify assets that are missing RFID tags. CMS is able to program RFID tags in the field which can then be installed by the ESI. To the extent the ESI identifies follow-up maintenance requirements, work orders can be generated and transmitted to the Work Management System (WMS). Independently, WMS compares any follow-up work orders to other similar work orders and asset data to determine optimal next steps.

Once the work order is complete the ESI receives the next inspection instructions and routing information on the CMS from the Scheduling System.

Scenario 2

The second scenario describes how a field worker performs planned work assignments with the use of a CMS device. The trigger for this scenario is a work order for TDBU maintenance work. Work orders may be generated as a result of the following:

- Condition-Based Monitoring Systems output
- Inspection output
- Trouble order output (e.g. an output of Scenario 3)
- AMS work order for time-based or other known maintenance needs

The Scheduling General Supervisor may assign Priority 1 work orders to Electrical Crews (E-Crews) within the Scheduling System. Priority 2 work orders are assigned by the Scheduling System to the optimal field crew based on field worker location, availability, skills, tools available on the vehicle, job duration, and the maintenance work location. In both instances the work order is delivered to the field worker via their local CMS device.

In addition to receiving the work order, the CMS device receives pertinent information in a graphical user interface that assists the field worker in his work. Such information could include the following:

- Customer information (name, address, phone number, access information)
- Interactive facilities maps (delivered onto a high quality viewer), including outage information provided by CMS and/or SmartConnect meters
- Circuit load information, including average and historic data, available down to the circuit segment and transformer level
- Maintenance history of asset, including pending work
- Operational history of assets in the surrounding area
- Predictive analysis that suggests next steps to the field worker for troubleshooting (based on sensor data obtained in the field)

- Work standards, manuals and tutorials

The field worker would also be equipped with various tools to both assist in the performance of his work, and create a safer work environment. These tools would consist of the following:

- Personal Voltage Detector for personal safety
- RFID read/write for validation of existing tags and creation of new RFID tags
- Camera (still and video, Bluetooth-enabled)
- Small unmanned vehicles (air and ground) for inspecting small or dangerous areas, or from vantage points not visible from the ground
- Components for live two-way video conferencing (camera, display and headset, all Bluetooth-enabled)
- Access to SCENet
- Wearable computer

Upon completion of the work the field worker would document the work performed and update the work order status via CMS. This process would automatically populate the employee's timesheet and share information with other back office systems. Prior to departure from the job-site the field worker would receive validation of service restoration via the CMS. This may occur through CMS communication with back office systems, or local probing of the SmartConnect meter or other sensors. If service is not restored the field worker would then initiate a new work order, forward all relevant information and instructions and order any necessary job-site materials, all via the local CMS device.

Scenario 3

The third scenario describes how a Trouble Worker performs unplanned work assignments using a CMS device. This scenario is similar to the second scenario, except for the manner in which work orders are initiated. In this scenario work orders are automatically generated from OMS as a result of either a "last gasp" message from the SmartConnect meter, or a customer call. Prior to initiating a work order, an operator at the Distribution Operations Center would verify that there is no line-side voltage via the SmartConnect meter, as discussed in use case D4. Work orders would then be delivered to a Trouble Worker via their CMS device. The remainder of the process is the same as scenario 2. Note that it is believed that much of the enriched information available via CMS (loading data, asset history, outage information) may be of even greater importance to the Trouble Worker than to the E-Crew.

Business Value

The benefits of implementing the CMS functionalities articulated in this use case include the following:

1. **Improved System Reliability**:
    a. **Increase Service Restoration Speed**: Improvements in the speed and availability of information in the field allows field workers to diagnose and repair assets more quickly, resulting in a more rapid restoration of service.
    b. **Increase Reliability Metrics**: Increases in the speed and efficiency of field workers, and increased service restoration speeds will result in higher reliability metrics.
2. **Improved Worker Safety**:
    a. **Improve Safety Metrics**: CMS provides real-time asset sensor information to the field workers. This will provide clearer diagnostic information and allow them to perform their jobs in a safer manner. The Personal Voltage Detector is one such device that will increase worker safety.
3. **Reduced Costs**:
    a. **Increase Trouble Shooting Accuracy**: Having improved information in the field allows field workers to increase their work capacity and reduces the amount of errors.
    b. **Improve Asset Information**: CMS allows field workers to validate and correct asset information within AMS in real-time and on a more frequent basis. This improves the accuracy of asset information which can improve maintenance schedules and provide other operations and financial benefits. In particular, confirming or correcting the relationship between transformers and the meter endpoints they serve has been deemed to be valuable information in several other SCE use cases.
    c. **Reduce Field and Windshield Time**: The ability to provide improved diagnostics and troubleshooting support will increase the efficiency of field workers and lead to a reduction in field and windshield times.
    d. **Avoid Unnecessary Callouts**: Trouble Workers are able to validate outage restoration using CMS while in the field, obviating the periodic need to send Trouble Workers to the field for a second visit.
    e. **Identify Joint Use Assets**: CMS allows field workers to identify joint assets (e.g. utility poles with shared use by the power and telecoms companies).
4. **Increased Customer Benefits**:
    a. **Increase Customer Satisfaction (Decrease SAIDI)**: Increases in the speed and efficiency of field workers, and increased service restoration speeds will result in higher customer satisfaction.
5. **Other Benefits**
    a. **Increase Revenue**: Some utilities use performance-based rates which are designed such that increases in customer satisfaction and reliability metrics could lead to increased revenues. This would not represent a benefit to SCE.

1.4 Business Rules and Assumptions

- Asset inspections and repairs in this use case are for distribution system assets (excludes substation and transmission assets).
- SCE will continue to have a regulatory requirement to perform visual Annual Grid Patrols (AGP) of grid-based assets in 2012 and beyond.
- Any other information captured by CMS during inspection is captured in the field because it has value to SCE from a monitoring standpoint, and there is no feasible way to capture this information remotely.
- SmartConnect metering has been installed across system to help provide circuit segment and transformer loading, and improved outage detection for display in CMS.
- RFID tags have been widely deployed to support the “drive by” AGP process and automatic asset confirmation functionality proposed for CMS.
- Communications network to support data exchange between CMS and utility has not yet been determined, but could be provided (or enhanced) by SmartConnect, other SCE distributed communications, a 3rd party, or some combination of these. This use case attempts only to articulate the functional requirements for the communications network.
- Significant training would be required to ensure field workers will be able to take advantage of new information and tools made available by CMS.

2. Actors

Describe the primary and secondary actors involved in the use case. This might include all the people (their job), systems, databases, organizations, and devices involved in or affected by the Function (e.g. operators, system administrators, customer, end users, service personnel, executives, meter, real-time database, ISO, power system). Actors listed for this use case should be copied from the global actors list to ensure consistency across all use cases.

Actor Name	***Actor Type (person, device, system etc.)***	***Actor Description***
Asset Management Engineer	Person	The Asset Management Engineer is responsible for paying attention to all the SCE field assets. SCE might have a more specialize role for the person who only monitors the transformers (e.g. a Transformer Asset Management Engineer). This person configures Asset Health Rules for submission to the Equipment Diagnostic Processor (discussed in use case D19).
Asset Management System (AMS)	System	The system that maintains asset information including but not limited to asset description, location, status, and maintenance history. Information stored in an asset's RFID tag should be consistent with AMS data.
Condition-Based Monitoring Systems (CBMS)	System(s)	Condition-Based Monitoring Systems (CBMS) represent a class of systems that monitor the status of field assets to help determine the need for maintenance activities. An example of such a system is the Equipment Diagnostic Processor in use case D19. The Equipment Diagnostic Processor is an application within the Enterprise Asset Management System that evaluates current asset condition data with respect to historical baseline data and, based on a series of factors, provides diagnoses and identifies probable "bad actors". The objective of CBMS is to identify and act upon potential problems before they result in service disruptions or asset damage.
Consolidated Mobile Solution (CMS)	System	A collection of remote field tools, mobile software, and the associated communications network infrastructure used by field workers. CMS shall be configured to be role-based, providing varying functionalities depending on the user.
Electrical System Investigator (ESI)	Person	Field personnel who perform asset inspections.
Field Worker	Person	Field personnel who perform maintenance activities on distribution assets. This also includes E-Crew personnel.

Actor Name	*Actor Type (person, device, system etc.)*	*Actor Description*
Scheduling General Supervisor	Person	Distribution Operations Center personnel that supervise the Scheduling System's scheduling of Field Workers. This individual may manually override Scheduling System to change the prioritization of work orders.
Scheduling System	System	The system that prioritizes and schedules inspection and work orders and delivers them to the ESI via CMS. Passport and Click are the systems that currently perform this function at SCE.
Trouble Worker	Person	Field personnel who act as "first responders" to problems in the field which need to be worked on or evaluated to determine the crews necessary to perform the work.
Work Management System (WMS)	System	The system that generates, prioritizes, archives, and delivers work orders to the Field Worker via CMS. It also tightly integrates with the Scheduling System and other back office systems. SAP Work Management will provide this function at SCE.

3. Step by Step analysis of each Scenario

Describe steps that implement the scenario. The first scenario should be classified as either a “Primary” Scenario or an “Alternate” Scenario by starting the title of the scenario with either the work “Primary” or “Alternate”. A scenario that successfully completes without exception or relying heavily on steps from another scenario should be classified as Primary; all other scenarios should be classified as “Alternate”. If there is more than one scenario (set of steps) that is relevant, make a copy of the following section (all of 3.1, including 3.1.1 and tables) and fill out the additional scenarios.

3.1 Primary Scenario: Field worker performs asset inspection with Consolidated Mobile Solution (CMS)

This scenario describes how Electrical System Inspectors (ESI) perform planned quinquennial (5-year) grid asset inspections with the use of a Consolidated Mobile Solution device (CMS). This device improves upon the existing inspection process by providing information to the ESI that is more timely and relevant, and enables them to perform both the 5-year asset inspection and the Annual Grid Patrol (AGP) of other distribution assets while en route to the grid asset inspection. CMS allows the ESI to obtain asset information while in the field to validate and, when possible, improve the accuracy facility maps. CMS also improves the effectiveness of the Asset Management System (AMS) and Condition-Based Monitoring Systems (CBMS) through real-time back-hauling of asset status information to those systems.

Triggering Event	***Primary Actor***	***Pre-Condition***	***Post-Condition***
(Identify the name of the event that start the scenario)	*(Identify the actor whose point-of-view is primarily used to describe the steps)*	*(Identify any pre-conditions or actor states necessary for the scenario to start)*	*(Identify the post-conditions or significant results required to consider the scenario complete)*
There is a time-based or condition-based requirement for an inspection of the distribution assets within a portion of the grid. For the purpose of this scenario the example of an Overhead Detailed Inspection (ODI) is used.	ESI	ESI is available to perform the asset inspection, has the tools and equipment necessary to perform the work, and has a functioning local CMS device.	Work order is completed and back office systems are automatically updated in near real-time via CMS.

3.1.1 Steps for this scenario

Describe the normal sequence of events that is required to complete the scenario.

Step #	*Actor*	*Description of the Step*	*Additional Notes*
#	*What actor, either primary or secondary is responsible for the activity in this step?*	*Describe the actions that take place in this step. The step should be described in active, present tense.*	*Elaborate on any additional description or value of the step to help support the descriptions. Short notes on architecture challenges, etc. may also be noted in this column.*
1	Scheduling System	Scheduling System sends a work order to an ESI via their CMS device.	Scheduling System is a general reference to a "black box" inspection / scheduling system, and may involve one or more existing or future work management and/or scheduling systems.
2	Scheduling System	Scheduling System provides routing instructions via CMS such that the ESI may perform visual patrol work while en route.	The visual patrol work is part of an Annual Grid Patrol (AGP) visual inspection, and the routing is determined with an effort to optimize the use of the ESI's presence in the geographic area to perform both the 5 year inspection of a particular asset and the annual visual inspection.
3	ESI	ESI receives the work order and routing instructions from the Scheduling System via CMS.	

Step #	*Actor*	*Description of the Step*	*Additional Notes*
4	ESI & CMS	While en route to the work order location, the ESI performs a visual Annual Grid Patrol inspection, while equipment on the vehicle performs passive monitoring of assets.	ESI to follow routing instructions requested by CMS. Passive monitoring may include RFID, thermal imaging, and noise analysis. This passive monitoring may also be performed by small unmanned aerial vehicles.
5	CMS	CMS stores data from passive monitoring of assets, then transmits the data to AMS and/or Condition-Based Monitoring Systems (CBMS).	This information is transmitted in real-time or near real-time. CMS also tracks and records the route patrolled. This information is used by the Scheduling System for future routing for purposed of AGP.
6	ESI	ESI arrives at grid area to be inspected.	An ESI would inspect the distribution assets within a 0.5 square mile section of the grid.
7	ESI & CMS	For each location included in the inspection area, the CMS validates the location, the work order assets, and other assets at that location by the RFID tag or data from other sensors. CMS also passively collects sensor information from other assets at that location, and confirms the presence or absence of assets expected to be at that location.	CMS would also communicate “red flags” to ESI, including bad dogs, access information, etc. If CMS identifies a discrepancy between the asset information maintained in AMS and asset information obtained in the field (either through passive monitoring or from the ESI’s inspection), this discrepancy will be reported to an Asset Management Engineer for resolution.

Step #	Actor	Description of the Step	Additional Notes
8	ESI	The ESI completes the inspection for the given location and sends data to the Asset Management System (AMS), CBMS and the Work Management System (WMS) via CMS.	Data that requires immediate attention and/or updates in back office systems shall be sent in real-time. All other information is sent in batch mode at the end of the work day.
8.5	ESI	If issues are identified that require additional work, the ESI shall initiate a follow-up work order via CMS.	
9	WMS	WMS compares the follow-up work orders to other similar work orders and asset data to determine optimal next steps.	
10	CMS	Work order is completed and timekeeping for the work order is updated automatically.	
11	ESI	The ESI then moves onto the next grid inspection as directed by the Scheduling System.	

3.2 Primary Scenario: Field worker receives planned work assignments and completes work using Consolidated Mobile Solution (CMS)

This scenario describes how Field Workers receive planned work assignments and complete the work with the use of CMS. This device improves upon the existing process by providing information to the Field Worker that is more timely and relevant, and enables them to troubleshoot with greater efficiency and improved safety.

Triggering Event	***Primary Actor***	***Pre-Condition***	***Post-Condition***
(Identify the name of the event that start the scenario)	*(Identify the actor whose point-of-view is primarily used to describe the steps)*	*(Identify any pre-conditions or actor states necessary for the scenario to start)*	*(Identify the post-conditions or significant results required to consider the scenario complete)*
A work order is generated as a result of: (1) a Condition-Based Monitoring System output; (2) an output from an inspection (e.g. an output of scenario 1); (3) an output from a separate trouble order (scenario 3) (4) AMS generates a work order for time-based or other known maintenance needs	Field Worker	Field Worker is available to perform maintenance work, has the tools and equipment necessary to perform the work, and has a functioning local CMS device.	Work order is completed and back office systems are automatically updated in near real-time via CMS.

3.2.1 Steps for this scenario

Describe the normal sequence of events that is required to complete the scenario.

Step #	***Actor***	***Description of the Step***	***Additional Notes***
#	*What actor, either primary or secondary is responsible for the activity in this step?*	*Describe the actions that take place in this step. The step should be described in active, present tense.*	*Elaborate on any additional description or value of the step to help support the descriptions. Short notes on architecture challenges, etc. may also be noted in this column.*
1	WMS	WMS sends work order to the Scheduling System	
2.1	Scheduling General Supervisor	Scheduling General Supervisor uses the Scheduling System to assign and deliver Priority 1 work orders to E-Crew via CMS.	CMS must be able to notify field worker and receive acknowledgement in real-time.
2.2	Scheduling System	Scheduling System assigns and delivers Priority 2 work orders to optimal crew via CMS.	Scheduling System considers the skills required, location of work orders, location of crews, tools required, and estimated job duration.
3	Field Worker & CMS	Field Worker receives work order on local CMS device.	
4	Field Worker	Field Worker receives pertinent information in heavy graphical interface on CMS. Such information includes, but is not limited to, the following: • Interactive facilities map (GIS) with outage indicators • Circuit, sub-circuit and transformer load information • Maintenance history of asset, including pending work • Customer information (name, address, phone number, access information) • Operational history of assets in the surrounding area (including event logs from meters, transformers, and recent switching history of circuits) • Predictive analysis that suggests next steps to the field worker for troubleshooting (based on sensor data obtained in the field) • Pre-established list of compatible units and materials	Information is based on real-time current status of assets in the area, and presented in high quality graphic interface. Field Worker would also be able to conduct on-demand ad hoc queries of other intelligent devices (including performing a ping of the meter.) The circuit, sub-circuit and transformer load information could potentially be provided by aggregated SmartConnect / AMI load data. See use cases D7 and D8 for further discussion.

Step #	Actor	Description of the Step	Additional Notes
		(linked to standards for that type of construction) • Work standards, manuals and tools	
5	Field Worker	Field Worker reaches destination equipped with the necessary tools to perform the work. Such tools include the following: • Personal Voltage Detector for safety • RFID read/write for validation of existing tags and creation of new tags • Camera (still and video, Bluetooth-enabled) • Small unmanned vehicles (air and ground) for asset inspection • Components for live two-way video conferencing (camera, helmet-mounted display and headset, all Bluetooth-enabled) • Access to SCENet • Wearable computer	Other tools may include the following: • Augmented reality peripheral devices • Unmanned flying device • Bluetooth camera, headset and display for live two-way video conferencing If CMS identifies a discrepancy between the asset information maintained in AMS and asset information obtained in the field (either through passive monitoring or from the ESI's inspection), this discrepancy will be reported to an Asset Management Engineer for resolution.
6	Field Worker	Field Worker uses CMS to guide decision making in determining course of action, and completes any required work.	
7	Field Worker	Field Worker documents the work performed and updates the work order status in WMS via CMS.	This process automatically populates the Field Worker's timesheet.
8	Field Worker	Field Worker validates service restoration.	Validation may occur via: • Contact with DOC • Probing the SmartConnect meter • Regression Test to confirm work did not cause new problems *Note:* Consider using SmartConnect

Step #	Actor	Description of the Step	Additional Notes
			for calculating outage time as a basis for reliability statistics (SAIDI / SAIFI).
9.1	Field Worker	If service is restored, the Field Worker completes the work order via CMS.	
9.2	Field Worker	If service is not restored, or if the Field Worker is unable to complete the work on their own, the Field Worker: 1. initiates a new work order; 2. forwards relevant information and instructions; 3. initiates job-site order for necessary materials	

3.3 Primary Scenario: Field worker receives unplanned work assignments and completes work using Consolidated Mobile Solution (CMS)

This scenario describes how Trouble Workers receive unplanned work assignments and complete the work with the use of CMS. This device improves upon the existing process by providing information to the Trouble Workers that is more timely and relevant, and enables them to troubleshoot with greater efficiency and improved safety.

Triggering Event	***Primary Actor***	***Pre-Condition***	***Post-Condition***
(Identify the name of the event that start the scenario)	*(Identify the actor whose point-of-view is primarily used to describe the steps)*	*(Identify any pre-conditions or actor states necessary for the scenario to start)*	*(Identify the post-conditions or significant results required to consider the scenario complete)*
A work order for partial-lights / no-lights is generated as a result of: (1) a "last gasp" message from a SmartConnect meter; or (2) a customer call	Trouble Worker	Trouble Worker is available to perform the work, has the tools and equipment necessary to perform the work, and has a functioning local CMS device.	Work order is completed and back office systems are automatically updated in near real-time via CMS.

3.3.1 Steps for this scenario

Describe the normal sequence of events that is required to complete the scenario.

Step #	*Actor*	*Description of the Step*	*Additional Notes*
#	*What actor, either primary or secondary is responsible for the activity in this step?*	*Describe the actions that take place in this step. The step should be described in active, present tense.*	*Elaborate on any additional description or value of the step to help support the descriptions. Short notes on architecture challenges, etc. may also be noted in this column.*
1	WMS	WMS sends work order to the Scheduling System.	
2	Scheduling System	Scheduling System schedules and delivers the work order to Trouble Worker via local CMS device.	
3	Trouble Worker & CMS	Trouble Worker receives work order on local CMS device.	DOC Operator is assumed to have verified via the SmartConnect meter that there is no line-side voltage at the customer site prior to dispatching a Trouble Worker (see use case D4).
4	Trouble Worker	Trouble Worker receives pertinent information in heavy graphical interface on CMS. Such information includes, but is not limited to, the following: • Interactive facilities map (GIS) with outage indicators • Circuit, sub-circuit and transformer load information • Maintenance history of asset, including pending work • Customer information (name, address, phone number, access information) • Operational history of assets in the surrounding area (including event logs from meters, transformers, and recent switching history of circuits)	Information is based on real-time current status of assets in the area, and presented in high quality graphic interface. Trouble Worker would also be able to conduct on-demand ad hoc queries of other intelligent devices (including performing a ping of the meter.)

Step #	Actor	Description of the Step	Additional Notes
		• Predictive analysis that suggests next steps to the field worker for troubleshooting (based on sensor data obtained in the field) • Pre-established list of compatible units and materials (linked to standards for that type of construction) • Work standards, manuals and tools	
5	Trouble Worker	Trouble Worker reaches destination equipped with the necessary tools to perform the work. Such tools include the following: • Personal Voltage Detector for safety • RFID read/write for validation of existing tags and creation of new tags • Camera (still and video, Bluetooth-enabled) • Small unmanned vehicles (air and ground) for asset inspection • Components for live two-way video conferencing (camera, helmet-mounted display and headset, all Bluetooth-enabled) • Access to SCENet • Wearable computer	Other tools may include the following: • Augmented reality peripheral devices • Unmanned flying device • Bluetooth camera, headset and display for live two-way video conferencing If CMS identifies a discrepancy between the asset information maintained in AMS and asset information obtained in the field (either through passive monitoring or from the ESI's inspection), this discrepancy will be reported to an Asset Management Engineer for resolution.
6	Trouble Worker	Trouble Worker uses CMS to guide decision making in determining course of action, and completes any required work.	
7	Trouble Worker	Trouble Worker documents the work performed and updates the work order status via CMS.	This process automatically populates the Trouble Worker's timesheet.
8	Trouble Worker	Trouble Worker validates service restoration.	Validation may occur via: • Contact with DOC • Probing the SmartConnect meter • Regression Test to confirm work

Step #	***Actor***	***Description of the Step***	***Additional Notes***
			did not cause new problems *Note:* Consider using SmartConnect for calculating outage time as a basis for reliability statistics (SAIDI / SAIFI).
9.1	Trouble Worker	If service is restored, the Trouble Worker completes the work order via CMS.	
9.2	Trouble Worker	If service is not restored, or if the Field Worker is unable to complete the work on their own, the Field Worker: 1. initiates a new work order; 2. forwards relevant information and instructions; 3. initiates job-site order for necessary materials	This step is one of the potential triggers for Scenario 2 (see section 3.2).

4. Requirements

Detail the Functional, Non-functional and Business Requirements generated from the workshop in the tables below. If applicable list the associated use case scenario and step.

4.1 Functional Requirements

Req. ID	*Functional Requirements*	*Associated Scenario #* *(if applicable)*	*Associated Step #* *(if applicable)*
1	Scheduling System shall ensure Priority 1 work orders for field work may be manually scheduled by a Scheduling General Supervisor and assigned to an E-Crew via CMS. The Scheduling System may communicate directly with CMS, or via SAP work management.	2	1 & 2
2	Scheduling System shall ensure Priority 2 work orders are prioritized, optimized and assigned.	2	2
3	Scheduling System shall ensure Work Orders are assigned to field personnel taking into consideration the respective locations of field personnel and grid assets (to optimize scheduling).	1, 2, & 3	Scenario 1: 1 Scenario 2: 2.2 Scenario 3: 2
4	Work Orders shall indicate the tools required.	1, 2, & 3	Scenario 1: 1 Scenario 2: 2.2 Scenario 3: 2
5	Scheduling System shall ensure Work Orders are assigned to field personnel taking into consideration the tools required and tools available on field personnel vehicles (to optimize scheduling).	1, 2, & 3	Scenario 1: 1 Scenario 2: 2.2 Scenario 3: 2
6	Work Orders shall indicate the field personnel skills required.	1, 2, & 3	Scenario 1: 1 Scenario 2: 2.2

Req. ID	*Functional Requirements*	*Associated Scenario #* *(if applicable)*	*Associated Step #* *(if applicable)*
			Scenario 3: 2
7	Scheduling System shall ensure Work Orders are assigned to field personnel taking into consideration the skills required versus skills possessed by field personnel (to optimize scheduling).	1, 2, & 3	Scenario 1: 1 Scenario 2: 2.2 Scenario 3: 2
8	Scheduling System shall ensure Work Orders are assigned to field personnel taking into consideration the estimated duration of the job (to optimize scheduling).	1, 2, & 3	Scenario 1: 1 Scenario 2: 2.2 Scenario 3: 2
9	Scheduling System shall ensure all grid inspections are scheduled within regulatory mandated timelines (and are prioritized as such).	1	1
10	Scheduling System shall ensure street level routing of ESI is optimized such that the ESI can perform Annual Grid Patrol inspections (AGP) while en-route to perform Overhead Detailed Inspections (ODI).	1	1 & 2
11	Scheduling System shall be capable of transmitting Annual Grid Patrol (AGP) inspection route information to the Electrical System Investigator (ESI) via CMS. The Scheduling System may communicate directly with CMS, or via SAP work management.	1	2
12	Work Management System shall be able to initiate a work order upon confirmation of an outage from the Outage Management System (OMS).	3	1
13	CMS device can be configured with role-based rules that provide varying functionalities depending on the user.	1, 2, & 3	
14	CMS device is capable of receiving work orders from the WMS/Scheduling System.	1, 2, & 3	3
15	CMS device is capable of receiving routing information from the Scheduling System.	1	3
16	CMS device is capable of presenting routing information to the ESI in a high quality visual display.	1	3
17	RFID tags on assets are geospatially aware. Specifically, they understand	1, 2 & 3	Scenario 1: 4 & 7

Req. ID	Functional Requirements	Associated Scenario # (if applicable)	Associated Step # (if applicable)
	where they are located geographically, and they understand their location with respect to other assets at that location (asset hierarchy).		Scenario 2: 5 Scenario 3: 5
18	CMS device on vehicle can perform passive inspection of streetlights to identify "day burners" (lights on during day).	1	4
19	CMS device on vehicle can perform passive inspection of streetlights to identify "lights out" (lights out at night).	1	4
20	CMS shall be able to analyze sensor data gathered in the field and suggest next steps to the field worker for troubleshooting.	2 & 3	4
21	CMS shall be able to verify current location using GPS.	1, 2, & 3	Scenario 1: 4 & 7 Scenario 2: 5 Scenario 3: 5
22	CMS shall have access to asset data and operations and maintenance histories.	1, 2, & 3	Scenario 1: 4 & 7 Scenario 2: 5 Scenario 3: 5
23	CMS shall be able to read, store and transmit local RFID information.	1, 2, & 3	Scenario 1: 4 & 7 Scenario 2: 5 Scenario 3: 5
24	CMS shall be able to read, store and transmit information from other sensors (e.g. remote sensors on poles, transformers or other assets).	1, 2, & 3	Scenario 1: 4 & 7 Scenario 2: 5 Scenario 3: 5
25	CMS shall be able to automatically compare asset information from AMS to asset information in the field (RFID or sensor data) to either validate the Asset Management System (AMS) information or identify discrepancies.	1, 2, & 3	Scenario 1: 4 & 7 Scenario 2: 5 Scenario 3: 5
26	CMS shall report AMS asset information discrepancies to an Asset Management Engineer for resolution.	1, 2, & 3	Scenario 1: 7 Scenario 2: 5

Req. ID	*Functional Requirements*	*Associated Scenario # (if applicable)*	*Associated Step # (if applicable)*
			Scenario 3: 5
27	CMS shall automatically capture time stamps and signatures for each asset (when the asset was inspected and by whom).	1, 2, & 3	Scenario 1: 4 & 7 Scenario 2: 5 Scenario 3: 5
28	CMS shall track and record the route patrolled.	1	5
29	The Scheduling System shall utilize historical information about routes patrolled for purposes of future Annual Grid Patrol scheduling and routing.	1	5
30	CMS shall prioritize data and send it to SCE back office systems based on prioritizations.	1, 2, & 3	Scenario 1: 5 & 8 Scenario 2: 4,5,7 & 9 Scenario 3: 4,5,7, & 9
31	CMS shall automatically close work orders.	1, 2, & 3	Scenario 1: 10 Scenario 2: 7 Scenario 3: 7
32	CMS shall display facilities maps with interactive drill down, zoom in/out and scrolling capabilities.	1, 2 & 3	Scenario 1: 4 & 7 Scenario 2: 4 & 5 Scenario 3: 4 & 5
33	CMS shall be able to display circuit, sub circuit and transformer load information (including load profiles), potentially sourced from aggregated SmartConnect / AMI data.	2 & 3	Scenario 1: 4 & 7 Scenario 2: 4 & 5 Scenario 3: 4 & 5
34	CMS shall be able to display maintenance histories of assets, including pending work.	2 & 3	Scenario 1: 4 & 7 Scenario 2: 4 & 5 Scenario 3: 4 & 5
35	CMS shall be able to display customer information (name, address, phone number, access information).	2 & 3	Scenario 2: 4 & 5 Scenario 3: 4 & 5

Req. ID	***Functional Requirements***	***Associated Scenario #*** ***(if applicable)***	***Associated Step #*** ***(if applicable)***
36	CMS shall be able to display operational histories of assets in the surrounding area (including event logs from SmartConnect meters, transformers, and recent switching history of circuits).	1, 2 & 3	Scenario 1: 4 & 7 Scenario 2: 4 & 5 Scenario 3: 4 & 5
37	CMS shall be able to display joint pole and asset information.	1, 2 & 3	Scenario 1: 4 & 7 Scenario 2: 4 & 5 Scenario 3: 4 & 5
38	CMS shall be able to display voltage histories from SmartConnect meter end points.	2 & 3	4 & 5
39	CMS shall be able to perform predictive analyses to suggest next steps to field workers for troubleshooting (based on sensor data obtained in the field).	2 & 3	5
40	CMS shall enable job-site ordering of materials for new work orders.	1, 2 & 3	Scenario 1: 8.5 Scenario 2: 9 Scenario 3: 9
41	CMS shall be able to suggest appropriate materials for new work orders given currently installed equipment, location information, voltage and load characteristics, etc.	1, 2 & 3	Scenario 1: 8.5 Scenario 2: 9 Scenario 3: 9
42	CMS shall be able to communicate with the Asset Management System (AMS) for retrieving or updating asset information.	1, 2, & 3	Scenario 1: 4,5,7 & 8 Scenario 2: 4 & 5 Scenario 3: 4 & 5
43	CMS shall be able to communicate with the Work Management System for receiving, submitting and updating work orders.	1, 2, & 3	Scenario 1: 8 & 10 Scenario 2: 1,7 & 9 Scenario 3: 1,7 & 9
44	CMS shall be able to communicate with Condition-Based Monitoring Systems (CMBS) to submit sensor data obtained in the field. (*See use cases D14 and D19 for a discussion of CBMS*).	1, 2, & 3	Scenario 1: 5 & 8 Scenario 2: 5 & 6

Req. ID	*Functional Requirements*	*Associated Scenario #* *(if applicable)*	*Associated Step #* *(if applicable)*
			Scenario 3: 5 & 6
45	WMS shall be able to send work orders to the Scheduling System.	1, 2 & 3	1
46	WMS shall be able to provide "red flags" to CMS (e.g. access information and bad dogs).	1, 2 & 3	Scenario 1: 7 Scenario 2: 4 Scenario 3: 4
47	CMS device can program a new RFID tag in the field for those assets that are found without them.	1	7
48	CMS can initiate work orders for emergent work identified in the field.	1, 2 & 3	Scenario 1: 8.5 Scenario 2: 9 Scenario 3: 9
49	CMS shall validate service restoration of meters in the vicinity via OMS. This shall occur prior to the ESI leaving the work location.	2 & 3	8
50	CMS shall be able to conduct on-demand ad hoc queries of the SmartConnect meter and other intelligent devices.	2 & 3	6 & 8
51	CMS shall allow for remote access to standards manuals, tutorials, asset information/manuals, etc.	1, 2 & 3	Scenario 1: 4 & 8 Scenario 2: 4,5 & 6 Scenario 3: 4,5 & 6
52	CMS shall be able to receive detailed locations of known outages and premises without power from OMS (which includes inputs from SmartConnect meters and customer calls).	2 & 3	4, 5 & 6
53	CMS shall be able to receive circuit loading data from the Energy Management System (EMS).	2 & 3	4, 5 & 6

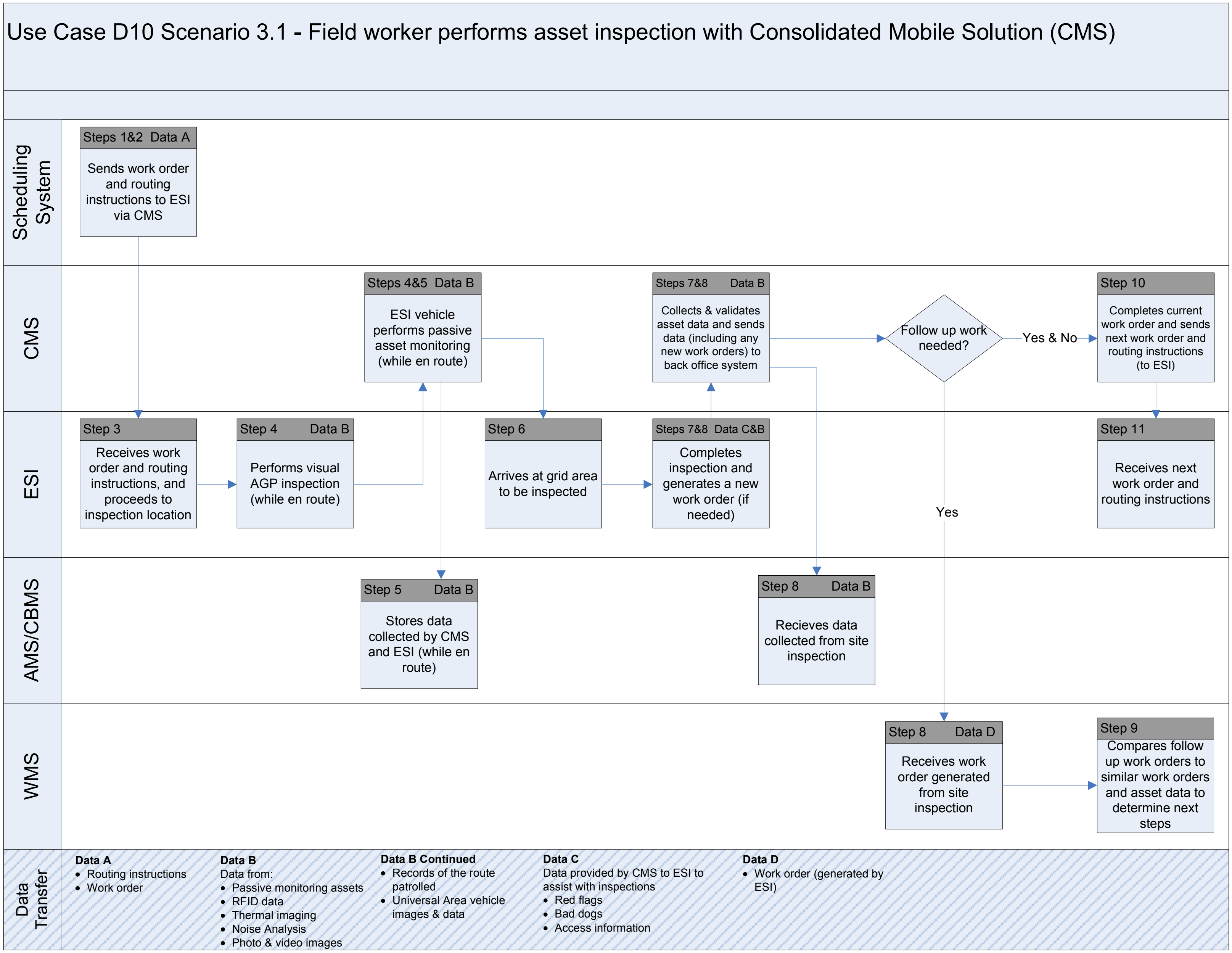
4.2 Non-functional Requirements

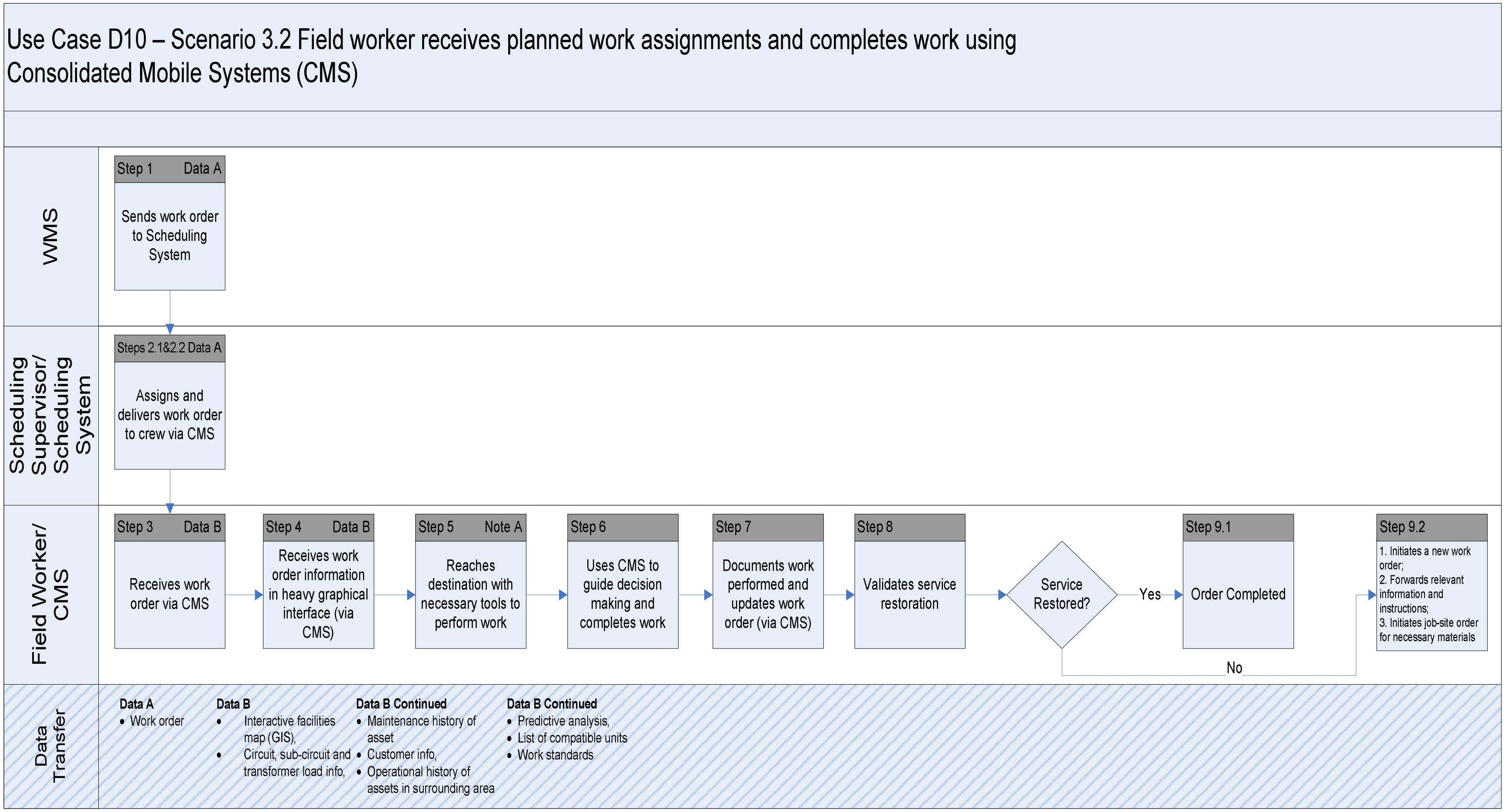
Req. ID	***Non-Functional Requirements***	***Associated Scenario #*** ***(if applicable)***	***Associated Step #*** ***(if applicable)***
1	Scheduling System shall be capable of transmitting work orders to CMS in the field as they are scheduled (near real-time).	1, 2 & 3	Scenario 1: 1 Scenario 2: 2 Scenario 2: 2
2	CMS shall be able receive relevant back office system data as it is updated in back office systems (near real-time).	1, 2 & 3	Scenario 1: 3 & 7 Scenario 2: 3,4,5 & 6 Scenario 3: 3,4,5 & 6
3	CMS shall be able to receive scheduled work orders from the Scheduling System as they are scheduled or modified (near real-time).	1, 2 & 3	3
4	CMS shall be able to receive outage indications form the Outage Management System (OMS) as they are detected (near real-time).	2 & 3	4, 5 & 6
5	CMS shall be able to receive circuit loading data from the Energy Management System (EMS) as it is updated (near real-time).	2 & 3	4, 5 & 6
6	CMS shall be able to access updates to circuit segment and transformer loading data (load profile and history data) as they become updated (near real-time).	2 & 3	4, 5 & 6
7	CMS shall be able to access updates to facility maps, standards manuals, etc. as they become available (near real-time).	1, 2 & 3	Scenario 1: 4 & 7 Scenario 2: 4,5 & 6 Scenario 3: 4,5 & 6
8	CMS can transmit work order completion information to utility back office as it is completed (near real-time).	1, 2 & 3	Scenario 1: 8.5 Scenario 2: 9 Scenario 3: 9

Req. ID	***Non-Functional Requirements***	***Associated Scenario #*** ***(if applicable)***	***Associated Step #*** ***(if applicable)***
9	CMS can initiate follow-on work orders to back office systems in near real-time (including any necessary materials orders).	1, 2 & 3	Scenario 1: 8.5 Scenario 2: 9 Scenario 3: 9
10	CMS can provide detailed work order information, asset / facility updates, inspection results, etc. either in near real-time or in batches (i.e. end of day).	1, 2 & 3	Scenario 1: 5, 8, 8.5 & 10 Scenario 2: 6,7 & 9 Scenario 3: 6,7 & 9

5. Use Case Models (optional)

This section is used by the architecture team to detail information exchange, actor interactions and sequence diagrams


Use Case D10 Scenario 3.1 - Field worker performs asset inspection with Consolidated Mobile Solution (CMS)
Scheduling System
CMS
ESI
AMS/CBMS
WMS
Data Transfer
Steps 1&2 Data A
Sends work order and routing instructions to ESI via CMS
Steps 4&5 Data B
ESI vehicle performs passive asset monitoring (while en route)
Steps 7&8 Data B
Collects & validates asset data and sends data (including any new work orders) to back office system
Follow up work needed?
Yes & No
Yes
Step 10
Completes current work order and sends next work order and routing instructions (to ESI)
Step 3
Receives work order and routing instructions, and proceeds to inspection location
Step 4 Data B
Performs visual AGP inspection (while en route)
Step 6
Arrives at grid area to be inspected
Steps 7&8 Data C&B
Completes inspection and generates a new work order (if needed)
Step 11
Receives next work order and routing instructions
Step 5 Data B
Stores data collected by CMS and ESI (while en route)
Step 8 Data B
Recieves data collected from site inspection
Step 8 Data D
Receives work order generated from site inspection
Step 9
Compares follow up work orders to similar work orders and asset data to determine next steps
Data A
• Routing instructions
• Work order
Data B
Data from:
• Passive monitoring assets
• RFID data
• Thermal imaging
• Noise Analysis
• Photo & video images
Data B Continued
• Records of the route patrolled
• Universal Area vehicle images & data
Data C
Data provided by CMS to ESI to assist with inspections
• Red flags
• Bad dogs
• Access information
Data D
• Work order (generated by ESI)

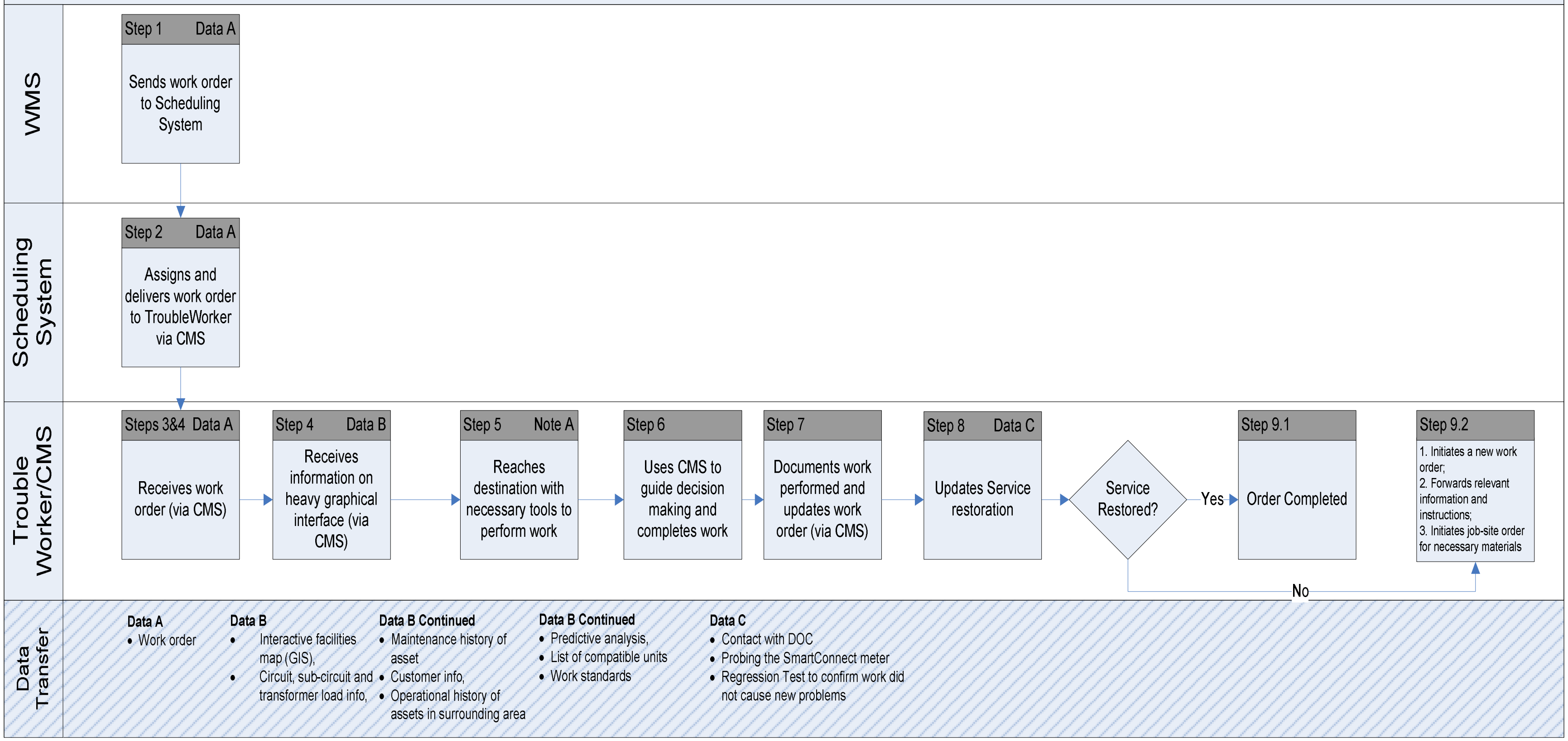


Note A
*These items are not data, but various tools
- Personal Voltage Detector
- RFID read/write for validation of existing tags and creation of new tags

Note A Continued
- Camera (still and video, Bluetooth enabled)
- Small unmanned vehicles
- Components for 2way video conferencing
- Access to SCENet

Note A Continued
- Wearable computer
- Augmented reality peripheral devices
- Unmanned flying device

Use Case D10 – Scenario 3.3 Field worker receives unplanned work assignments and completes work using Consolidated Mobile Systems (CMS)



Note A
*These items are not data, but various tools
- Personal Voltage Detector
- RFID read/write for validation of existing tags and creation of new tags

Note A Continued.
- Camera (still and video, Bluetooth enabled)
- Small unmanned vehicles
- Components for 2way video conferencing
- Access to SCENet

Note A Continued.
- Wearable computer
- Augmented reality peripheral devices
- Unmanned flying device

6. Use Case Issues

Capture any issues with the use case. Specifically, these are issues that are not resolved and help the use case reader understand the constraints or unresolved factors that have an impact of the use case scenarios and their realization.

Issue
Describe the issue as well as any potential impacts to the use case.
To facilitate having an effective decision support process for Trouble Workers in the field, the information available to the Trouble Workers via CMS needs to also be available to the Damage Assessment Team.
Additional information about asset health may lead to increased amounts of maintenance work.
Changes to the processes by which assets are inspected and maintained may suggest the need for organizational changes to support these modified asset management functions.

7. Glossary

Insert the terms and definitions relevant to this use case. Please ensure that any glossary item added to this list should be included in the global glossary to ensure consistency between use cases.

Glossary	
Term	**Definition**
Distribution Operations Center (DOC)	The Distribution Operations Center (DOC) is the location at which Operators monitor the distribution system, perform remote actions (i.e. operating switches), and take other actions on circuits to preserve grid stability. Operators at the DOC dispatch Trouble Workers and crews to perform trouble shooting and repair work.
Distribution Operations Center Operator	Personnel at the DOC who remotely evaluate sensor data to validate the need to dispatch Trouble Workers to the field for repair work.
Electrical Crew (E-Crew)	An E-Crew consists of 3 to 4 persons that perform work on power lines based on construction work orders and maintenance repair work orders. Crews typically consist of a Lineman, Apprentice and Groundman. E-Crews are currently managed in ClickSchedule by a Scheduling General Supervisor.
RFID (Radio Frequency Identification)	RFID is a method of automatic identification via radio signal. The technology relies on the storage and remote retrieval of data using RFID tags or transponders. The data is retrieved from RFID tags using RFID readers.
SmartConnect	SmartConnect is the name of Southern California Edison's Advanced Metering Infrastructure program. This program plans to install approximately 5 million advanced electric revenue meters capable of two-way communications with the utility. This device shall serve as a gateway between the utility, customer-site, and customer load controllers. The meter measures, records, displays, and transmits data such as energy usage, generation, text messages, event logs, etc. to authorized systems (i.e., the SmartConnect NMS) and provides other advanced utility functions.
TDBU (Transmission & Distribution Business Unit)	The business unit that manages the installation, operations and maintenance of the utility's transmission and distribution assets.

8. References

Reference any prior work (intellectual property of companies or individuals) used in the preparation of this use case

1. Line Worker of the Future and Asset Information Improvements.
2. 2009 SCE GRC Testimony of Consolidated Mobile Solution.

9. Bibliography (optional)

Provide a list of related reading, standards, etc. that the use case reader may find helpful.